

# **Health Consultation**

**Lawrence Berkeley National Laboratory  
Berkeley, California**

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Division of Health Assessment and Consultation  
Agency for Toxic Substances  
And Disease Registry**

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## **BACKGROUND AND STATEMENT OF ISSUES**

In December 1998, the Agency for Toxic Substances and Disease Registry (ATSDR) received a request for a petition to evaluate the area surrounding the Lawrence Berkeley National Laboratory (LBNL) in Berkeley, California [1]. The Agency for Toxic Substances and Disease Registry (ATSDR) received data and related documents for its review and prepared this consultation. The data consisted of information packages supplied to ATSDR from the California Department of Health Services Cancer Surveillance Section [2, 3], the U.S. Environmental Protection Agency (EPA) [4, 5], and the community group petitioning ATSDR [1].

The issues associated with this petition include tritium (H-3) releases from LBNL, possible cancer clusters and infertility issues in the neighborhoods surrounding the facility and drinking water issues associated with the Summit Reservoir. This consultation directly responds to the H-3 issues, the issue of cancer clusters as evaluated by the California Department of Health Services [2, 3], the water quality of the Summit Reservoir and issues of infertility.

## **DISCUSSION**

The LBNL facility is operated by the University of California for the Department of Energy (DOE) and is part of the nationwide system of national laboratories. Within LBNL is the National Tritium Labeling Facility (NTLF) that has documented releases of tritium (H-3) into the environment, both air and water with H-3 incorporation into biota [6]. In 1997, the NTLF prepared an environmental assessment [6] and ATSDR, upon request from DOE, supplied comments on the draft environmental health risk assessment [7]. LBNL has also been cited for violations of several environmental regulations including violations of the National Emission Standards for Hazardous Air Pollutants (NESHAPS) in 1991 [4]. Environmental sampling results for H-3 previously supplied to ATSDR included biota plus air, water, and documents supplied in support of the petition. For our review of the radiological issues associated with H-3, we reviewed the data supplied by the petitioning organization, our previous activities regarding the NTLF [7], the 1997 environmental report for the LBNL available on the internet [8], federal regulations as promulgated by the EPA [9], the U.S. Nuclear Regulatory Commission (NRC) [10], and proposed legislation of DOE [11]. These regulations pertain to: 1) National Emissions Standards for Hazardous Air Pollutants (NESHAPS) - Radionuclides; 2) Standards for Protection Against Radiation and; 3) Radiation Protection of the Public and the Environment, respectively. ATSDR also reviewed newly released reference material from the National Council on Radiation Protection and Measurements [12, 13].

## **CONCLUSIONS**

The atmospheric concentrations of H-3 in the off-site environs of Berkeley are at least an order of magnitude below the regulatory requirements of the EPA, NRC, and DOE. Even in July 1998

when the lab released 35 curies (1.3 million megabecquerels) of H-3 to the air, the resulting dose to an off-site individual was estimated at less than 0.5% of the NESHAPS annual effective dose limit of 10 millirem per year (0.1 millisievert, mSv) although the concentration of H-3 within the facility was greater than limits expressed in the LBNL operational guidance [14]. An individual within the contaminated area received an estimated dose of 1 millirem (0.01 mSv), the occupational limit being 5,000 millirem (50 mSv) and the public limit being 100 millirem (1 mSv). Preliminary studies of H-3 in biota (trees surrounding NTLF) indicate that the uptake of H-3 is minimal with the potential off-site doses estimated at less than 0.1 millirem (0.001 mSv). Regarding biota, H-3 in plants was indistinguishable from background concentrations at a distance of less than 250 meters from the stacks at the facility [15]. This is in good agreement with an earlier report suggesting similar estimated doses [8].

In 1997, the site environmental report indicates that H-3 from the NTLF was responsible for about 88% of the radiological dose from LBNL [8]. That dose was reported as  $1.4 \times 10^{-3}$  mSv (0.14 millirem) and is about 700 times lower than the federal regulation limiting exposure to the public [10]. The total dose from LBNL activities as reported in the 1997 site environmental report was  $1.59 \times 10^{-3}$  mSv.

In March 1999, the California Department of Health Services Cancer Surveillance Section (CDHS-CSS) reviewed cancer incidence data for neighborhoods surrounding the LBNL facility which included the Berkeley Hill and Kensington areas. The review covered the 15-year period from 1983 to 1997 and included invasive cancers of the bladder, bone, brain, breast, colon, lung, ovary, prostate, thyroid, and body of the uterus [2]. The occurrence of invasive cancer for the area surrounding the LBNL facility was compared to cancer occurrence in the San Francisco Bay area. As reported, there was "no indication of an unusual occurrence of cancer cases among the population of the LBNL area" for the time period reviewed [2].

In April 1999, following another request from the petitioning organization, the CDHS-CSS evaluated the incidence of invasive cancer in census tract 4001 during the three-year period from 1988 to 1990 [3]. This tract contains several streets around the LBNL facility that were not included in the earlier report. The CDHS-CSS concluded that the observed number of invasive cancers in census tract 4001 was slightly higher than the number of cases they expected to see if they assumed that cancer occurred at the same rate in this census tract as in the San Francisco Bay area. However, the CDHS-CSS stated the apparent increases are within the range of statistical variation that can be expected to occur by chance alone [3]. The report also concluded that breast cancer occurrence in this census tract was significantly higher than in the Bay Area, but "such occurrences are seen frequently in higher socioeconomic areas throughout California and the country as a whole" [3]. The report includes a discussion of possible risk factors for breast cancer. Furthermore, in 1991 breast cancer rates for this area were not elevated. Based on this evaluation, CDHS-CSS concluded that cancer rates in the area surrounding LBNL were no different from other areas in the San Francisco Bay.

The Summit Reservoir issues were addressed by contacting the California Department of Health Services, Drinking Water Program who referred ATSDR Region IX staff to the East Bay

Municipal Utilities District (EBMUD). From these conversations ATSDR has learned that the Summit Reservoir, a 200 acre covered reservoir that is part of the EBMUD storage system, provides drinking water to the City of Berkeley and residential areas adjacent to the reservoir. The cover was installed in 1972. The reservoir is upwind from the LBNL during prevailing winds. Water from reservoir is blended with other sources prior to delivery by local water distribution systems which perform routine water analysis at distribution points in compliance with EPA Drinking Water Regulations. Although routine water samples are not collected from the reservoir for gross beta or tritium analysis, the results of samples collected for specific contaminants of concern are available (e.g heavy metals/sediments and others). The reservoir(s) is not replenished via natural surface/groundwater sources; therefore, the system is not impacted from potentially contaminated surface or groundwater from the LBNL area.

To address the issues of infertility, ATSDR searched the National Library of Medicine using the search terms "tritium" and "infertility" and no information was found other than those reports where tritium had been used in biomedical research in a laboratory environment. A search of "radiation dose" and "infertility" returned many research papers; most of these dealt with combination of radiation treatment and/or chemotherapy for various cancer treatments.

In general, the sperm-producing tissues are very sensitive to ionizing radiation. Radiation-induced damage, with changes to spermatogonia occurring following as little as 0.1 Gy (10 rads) and permanent infertility after fractionated doses (doses given over a period of time) of 2 Gy (200 rads) and above. In females, high-dose chemotherapy, total body irradiation, and irradiation at an ovarian dose above 6 Gy (600 rads) usually result in permanent ovarian failure [16]. In a study of German nuclear plant workers, Straube and coworkers [17] investigated fertility in these individuals. The frequency of workers (both male and female) exposed to ionizing radiation among 270 infertile couples was retrospectively compared to a control fertile population using a pair-matched analysis, a type of case-controlled epidemiological study. The results of this study showed no differences in the frequency of nuclear power plant exposure between sterile and fertile groups. However, there was a higher rate of temporary anomalous sperm development in nuclear power plant workers. In essence, the radiation dose necessary to either affect the reproductive capabilities or induce sterility in humans is several orders of magnitude higher than the radiation doses received from tritium released from LBNL.

In summary, we have reviewed both environmental data and health outcome data. This review finds no apparent indication that the health of nearby residents is at risk from radiological releases from the Lawrence Berkeley National Laboratory and the National Tritium Labeling Facility.

## **RECOMMENDATIONS**

No additional follow-up recommendations are made at this time.

Paul A. Charp, Ph.D.  
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